

CV STEP Translator

CAMU Assembly to STEP Part
Translations

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Parts & Assemblies

The words 'Part' and 'Assembly' mean different things to different people. Define them as follows for this discussion:

Mechanical Part: Smallest separable physical item in a Mechanical Design.

Mechanical Assembly: Combination of Mechanical Parts.

CAD Part: A single database file describing *one or more* Mechanical Parts. Model entities are defined in a Part coordinate system (Part Space).

CAD Assembly: A database file describing an assembly level coordinate system (Assembly Space) and the specific locations and orientations of one or more CAD Parts.

Parts & Assemblies

Part files differ among CAD systems!

- CV: Part Files can describe more than one solid entity.
- ProE: Part Files can describe more than one solid entity, but warn against it.
- Solidworks (Parasolids Kernel): Part Files describe only a single solid entity, i.e. one base feature.

How does this effect us?

- If engineers use SolidWorks and Designers use CV on the same project, there won't be a one-to-one correlation between databases.
- It can work but, we need to develop guidelines for sharing engineering data between CAD systems.

MSR Rover Project

- Using CV Part Modeler and CAMU Assembly Modeler as Primary CAD Tools.
- Other CAD systems are being used on MSR Project.
 - Lockheed Martin uses SDRC.
 - JPL Cog. E's are using SDRC & Solidworks for layout and part modeling.
- Currently using STEP translations to Share Engineering Reference Data between CAD systems.

STEP

What is STEP?

- Standard for the Exchange of Product model data.
- ISO Standard.
- Universal language for describing solid modeling data...and lots of other things.
- CAD packages can (or will) read and write STEP files to exchange solid modeling data.

Translating CV Databases

- JPL has a third-party STEP translator for CV Part files (not CAMU Assemblies).
- To export a CAMU Assembly to STEP Now:
 - Activate the Assembly and a new Part File
 - Copy the entire Assembly of Parts into the new Part File.
 - Run the STEP Translator on the new Part File.
 - Result is a STEP file that describes a single Part with multiple solid entities (STEP Part File).
 - Preparing new Part File can take hours of manual labor.

STEP Part File

- STEP Part Files contain solid modeling data, not product structure (Assembly tree).
- That's all right! Do not want to deliver entire product structure, just engineering reference data to project partners and engineers.
- No immediate need to purchase or develop translator for product structure.
- Need to make CAMU translations to STEP Part Files more efficient: Wrote software, CAMU2STEP, to automate procedure.

CAMU2STEP

- User selects branch of CAMU Tree.
- Prog. Reads Tree and makes list of Component Instances. For each, stores the associated Part Model and its orientation in the Assembly level coordinate system.
- For each Unique Part Model, Prog. writes config file and executes STEP Translator.
- For each Component Instance, Prog. takes the associated STEP file and writes a copy with all of the entities mapped into the Assembly level coordinate system.
- Prog. Cuts the Solid entity data from each STEP file and combines it in a single STEP file.

Mapping Coordinates From Part Space to Assembly Space

\bar{O} = Part Origin in Assembly Space

$[ax, ay, az]$ = Part Orientation in Assembly Space

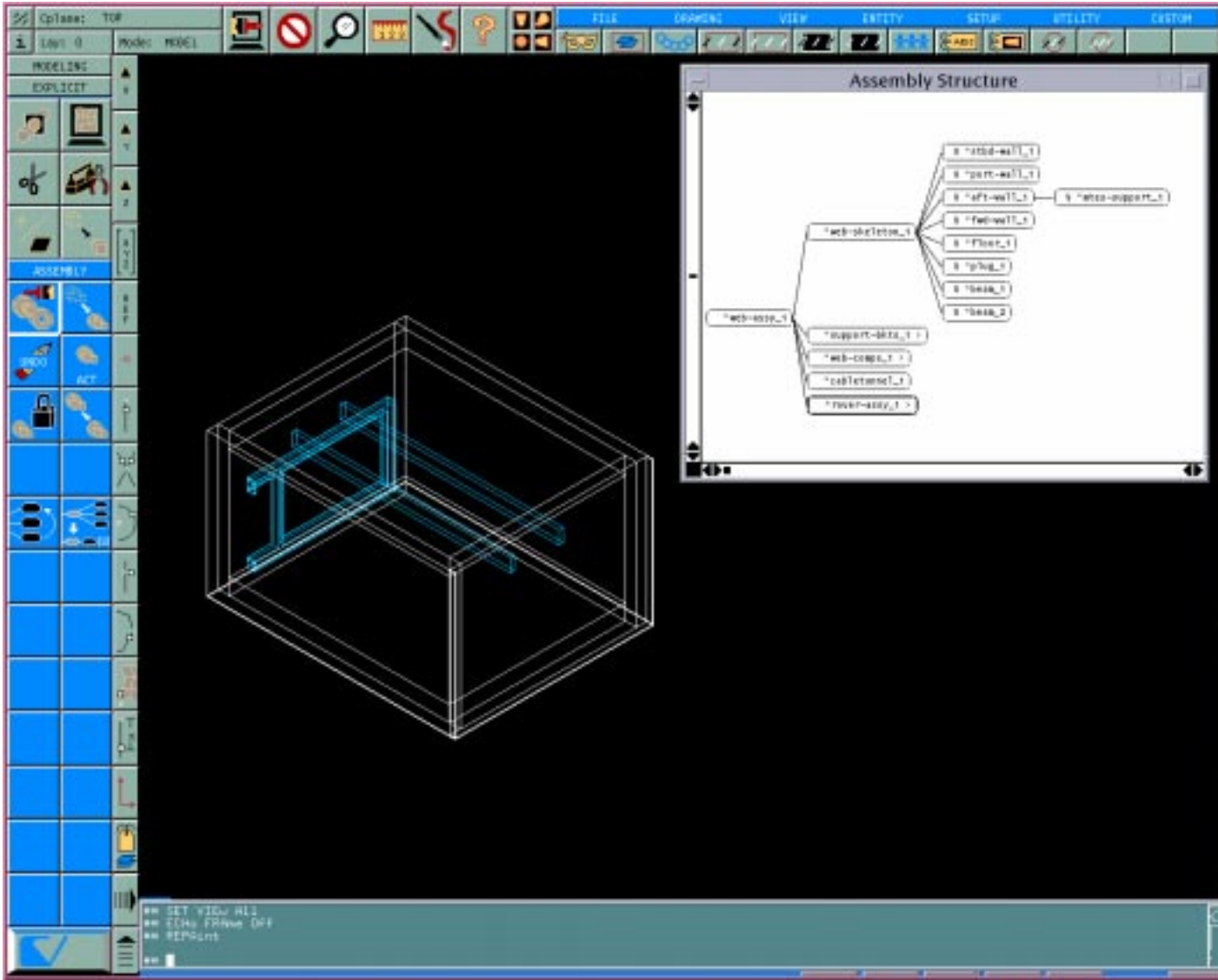
(CV uses the xyz-convention to describe rotations)

Transformation Matrix, [M]	$M(1,1) = \cos(ay) * \cos(az)$
	$M(1,2) = \sin(ax) * \sin(ay) * \cos(az) - \cos(ax) * \sin(az)$
	$M(1,3) = \cos(ax) * \sin(ay) * \cos(az) + \sin(ax) * \sin(az)$
	$M(2,1) = \cos(ay) * \sin(az)$
	$M(2,2) = \sin(ax) * \sin(ay) * \sin(az) + \cos(ax) * \cos(az)$
	$M(2,3) = \cos(ax) * \sin(ay) * \sin(az) - \sin(ax) * \cos(az)$
	$M(3,1) = -\sin(ay)$
	$M(3,2) = \cos(ay) * \sin(ax)$
$M(3,3) = \cos(ax) * \cos(ay)$	

Coordinate in Part Space, P_p , mapped into coordinate in Assembly Space, P_A by:

$$\bar{P}_A = [M]\bar{P}_p + \bar{O}$$

CV CAMU Assembly



Transcript of CAMU2STEP Demo

```
## RUN CVMac CAMU2STEP
```

```
COMPUTERVISION CVMAC PROCESSOR VERSION 1.00 7-23-98
```

```
Reading tree '=s2dsk6.cadds.parts.md.msrover.webtmp.b' please wait...
```

```
Choose a component instance or [CR] for root node: web-skeleton_1
```

```
Choose a name for the STEP file [step]: demostep
```

```
Getting complete list of component instances in branch...
```

```
Removing viewed-off parts from list...
```

```
Getting CADDSPath...
```

```
Getting full path names of parts...
```

```
Making list of unique parts to translate...
```

```
Checking for up-to-date STEP files...
```

```
This requires writing 8 STEP files.
```

```
Type OK to continue: ok
```

```
Writing STEP files...
```

```
Translating '=s2dsk6.cadds.parts.md.msrover.djl.beam'...
```

```
Translating '=s2dsk6.cadds.parts.md.msrover.djl.plug'...
```

```
Translating '=s2dsk6.cadds.parts.md.msrover.djl.floor'...
```

```
Translating '=s2dsk6.cadds.parts.md.msrover.djl.wall-f'...
```

```
Translating '=s2dsk6.cadds.parts.md.msrover.djl.wall-a'...
```

```
Translating '=s2dsk6.cadds.parts.md.msrover.djl.wall-p'...
```

```
Translating '=s2dsk6.cadds.parts.md.msrover.djl.wall-s'...
```

```
Translating '=s2dsk6.cadds.parts.md.msrover.djl.support-mtes'...
```

```
Mapping STEP files for each component instance...
```

```
Mapping 'beam_2'...
```

```
Mapping 'beam_1'...
```

```
Mapping 'plug_1'...
```

```
Mapping 'floor_1'...
```

```
Mapping 'fwd-wall_1'...
```

```
Mapping 'aft-wall_1'...
```

```
Mapping 'port-wall_1'...
```

```
Mapping 'stbd-wall_1'...
```

```
Mapping 'mtes-support_1'...
```

```
Writing header to STEP file...
```

```
Parsing solids and renumbering STEP files...
```

```
Parsing 'beam_2'...
```

```
Parsing 'beam_1'...
```

```
Parsing 'plug_1'...
```

```
Parsing 'floor_1'...
```

```
Parsing 'fwd-wall_1'...
```

```
Parsing 'aft-wall_1'...
```

```
Parsing 'port-wall_1'...
```

```
Parsing 'stbd-wall_1'...
```

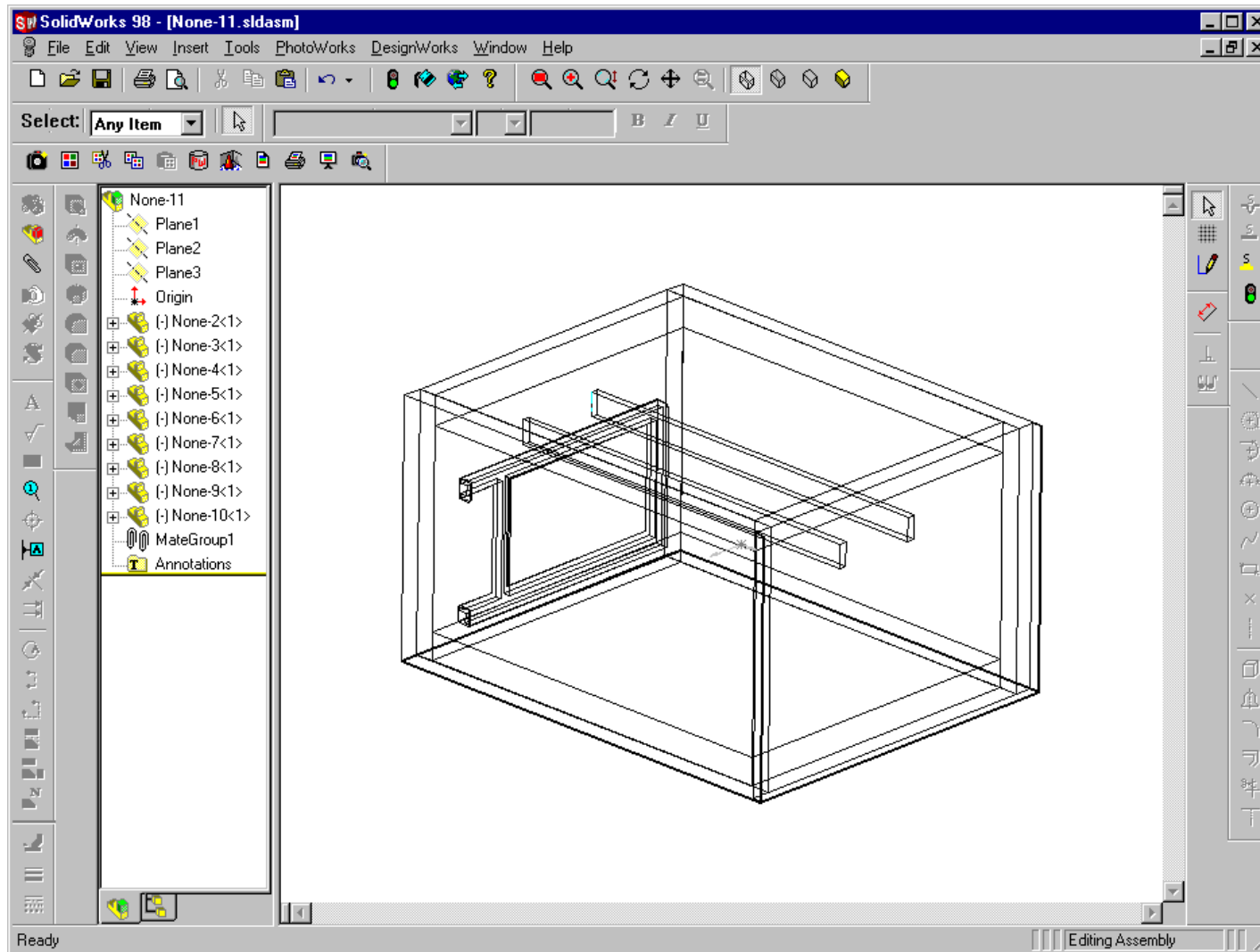
```
Parsing 'mtes-support_1'...
```

```
Adding footer to STEP file...
```

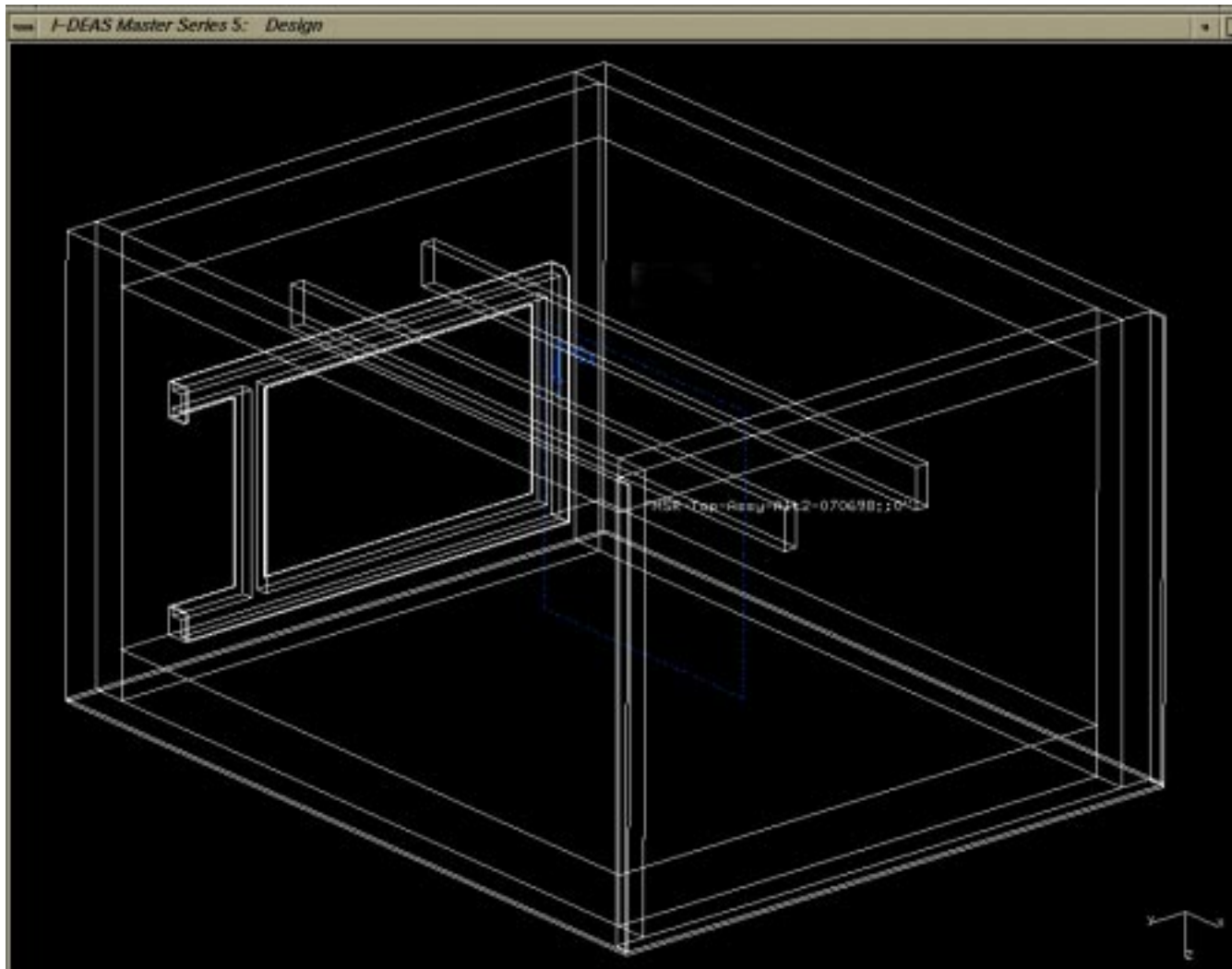
```
Finished!
```

```
##
```

STEP File Read Into SolidWorks



STEP File Read Into SDRC



Questions?

- Should we continue working on a STEP Part translator or should we wait for a translator that works on product structure?
- How else can we use STEP (or other Translation Schemes) here at JPL?
- How can we control engineering data that's being exchanged?